FINAL TECHNICAL REPORT

Cloud Condensation Nuclei Measurements in Shiptrails

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The Desert Research Institute (DRI) Cloud Condensation Nuclei (CCN) spectrometer was mounted on the University of Washington (UW) C-131A research aircraft for the Monterey Area Ship Tracks Experiment (MAST) project in June, 1994. This instrument operated successfully throughout the dozen flights over this one month period. The spectral CCN data from this instrument were reduced and placed in the MAST archives. The P.I. attended several workshops before and after the field project. In addition to this several data requests from other MAST scientists were also honored. As a result, the P.I. was a coauthor of several of the MAST special issue papers. The P.I. was the lead author on one of the papers for the MAST special issue. This paper was written in collaboration DRI graduate students and with Professor Peter Hobbs and his students at UW. The revised version of this manuscript, which responded to the reviewer comments, after conditional acceptance, was recently submitted to the editor. The abstract of this final version follows.

Enhancements of droplet concentrations in clouds affected by four ships were fairly accurately predicted from ship emission factors and plume and background cloud condensation nucleus (CCN) spectra. Ship exhausts thus accounted for the increased droplet concentrations in these "ship tracks." Derived supersaturations were typical of marine stratus clouds, although there was evidence of some lowering of supersaturations in some ship tracks closer to the ships where CCN and droplet concentrations were very high.

Systematic differences were measured in the emission rates of CCN for different engines and fuels. Diesel engines burning low grade marine fuel oil produced order of magnitude higher CCN emissions than turbine-engines burning higher grade fuel. Consequently, diesel ships burning low grade fuel were responsible for nearly all of the observed ship track clouds. There is some evidence that fuel type is a better predictor of ship track potential than engine type.

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